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Fabrication and Characterization of Jute Kenaf and Coir Fiber Composite Material

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Abstract: ***It is acknowledge about the raw materials properties and biodegradable composites used in preparing such composites material which are being used for packing of goods, automobiles manufacturing, medical and in the feild engineering .Work is done in investigating the Tensile strength and compressive strength and water absorption of composites made by using jute, coir and by kenaf fiber of different ratio with epoxy ly556 resin matrix material. The reinforcement hybrid composite shows almost equal strength to that of the particle board when compared. but the cost is lesser for natural fibers composite material. Composite containing 60% jute and 40% coir has shown good strength, high density, less rate of water absorption and lower price which are economically and environmental friendly.***
Keywords: Jute fiber, Kenaf fiber , Coir fiber , Epoxy resin

I. INTRODUCTION

The composite material are known commercially for their applications the field of aerospace, construction, automobiles etc The industries have shifted them self from the commercial materials to natural fibers like metal ,wood, alloys etc to the alternative material such as composites. The composites are much suitable for their varies uses like low cost and light in weight .the use of this composite ,material changed the world of thing. Every commercial industries looking for a kind of alternative in their field to attain high profit in their field by using composites which are economical and greatly available in the nature. Natural fiber that reinforced with matrix like epoxy composites has given higher performance found in diverse applications in resisting extensive impact load, fuel holding cylinders, propeller blades, cam and crank shafts, beams for supporting bridges and paper rollers. For specific applications, the usage for composites material rather using metals.

II. LITERATURE SURVEY

Muralidharan.S[1] have analyzed the mechanical characters of jute and also kenaf fiber polymer reinforced material. He has studied the compression and tensile strength of both the fibers with various fraction of composite fibers in a ratio of 1:2 ratio .The specimens are fabricated with various weight ratio fraction of jute as a fiber up to optimization mark of tensile strength a small quantity of kenaf is mixed and various tests are conducted. His analysis is to fabricate the kenaf – jute natural fibers reinforced composites for evaluation of mechanical properties such as tensile strength and compression strength of jute& kenaf hybrid reinforced composites.

R. Panneerdhass[2] studied the tensile, compression, impact strength and water absorption characteristics of husk of groundnut and luffa fiber epoxy resin hybrid composites material. The best results in term of mechanical properties are obtained with 40% ground nut and 60% luffa fiber.

M. R. Sanjay, B. Yogesha[3] has carried out his study to examine composites prepared of jute and E-Glass fibers made by hand lay-up method using LY556 polymer Epoxy resin and HY951 as a catalyst . The properties like tensile, impact, and fatigue shear strength are calculated by ASTM standards. The composite of jute fiber has good properties compared with glass fiber composite

III.MATERIALS & METHODS:

A. Polymer resin (Epoxy LY-556)
B. Catalyst (HY-951)
C. Jute, Kenaf and coir fibers
D. Aluminum foil
E. NaOH Solution

Hand lay-up technique is one of the simple method for composite processing. The steps involved in this method are simple. Aluminum sheet are placed on the upper and lower end to get surface finish. For Reinforcement fibers are made into mats based on the mold size. The polymer resin is mixed in a appropriate ratio. The fibers are properly arranged systematically and resin is applied uniformly with the use of brushes. The air gaps formed are removed using the syringes.

IV. COMPOSITIONS

1) *Sample A:* Kenaf fibers are sacking materials. It is biodegradable environmentally friendly, these fibers are reinforced with Coconut fiber husk In this work, epoxy resin LY556 is mixed with hardner HY 951. Kenaf and Coir fibers are arranged at different compositions. Resin has applied on aluminum film sheet, kenaf and coir fiber for various number of layers are placed by applying resin. Kenaf 60% layers and Coir 40% layers are positioned in the open mold, and resin is applied, brushed, or sprayed over. Air is removed with rollers to complete laminates structure. The thickness is controlled by layers placed against the mold, curing is done for 24 hrs so that work pieces will get hard. After that specimens are cut based on ASTM standards.
2) *Sample B:* Kenaf fibers are sacking materials. It is biodegradable environmentally friendly, these fibers are reinforced with Coconut fiber husk In this work, epoxy resin LY556 is mixed with hardener HY 951. Kenaf and Coir fibers are arranged at different compositions. Resin has applied on aluminum film sheet, kenaf and coir fiber for various number of layers are placed by applying resin. Kenaf 40% layers and Coir 60% layers are positioned in the open mold, and resin is applied, brushed, or sprayed over. Air is removed with rollers to complete laminates structure. The thickness is controlled by layers placed against the mold, curing is done for 24 hrs so that work pieces will get hard. After that specimens are cut based on ASTM standards
3) *Sample C:* Jute fiber is low cost, eco-friendly also have moderate mechanical properties which makes it a better alternative. Potentially jute shows the best eco-friendly natural fiber, when mixed with Kenaf fiber. Kenaf fiber are good sacking materials. biodegradable and environmental friendly. In this work ,epoxy resin LY556 is mixed with hardener HY 951. jute and kenaf fibers are arranged at different compositions. Resin has applied on aluminum film sheet, kenaf and jute fiber for various number of layers are placed by applying resin. Jute 60% layers and kenaf 40% layers are positioned in the open mold, and resin is applied, brushed, or sprayed over. Air is removed with rollers to complete laminates structure. The thickness is controlled by layers placed against the mold, curing is done for 24 hrs so that work pieces will get hard. After that specimens are cut based on ASTM standards
4) *Sample D:* Jute fiber is low cost, eco-friendly also have moderate mechanical properties which makes it a better alternative. Potentially jute shows the best eco-friendly natural fiber, when mixed with coir fiber. Coir fiber also have good sacking materials. biodegradable and environmental friendly. In this work ,epoxy resin LY556 is mixed with hardener HY 951. jute and coir fibers are arranged at different compositions. Resin has applied on aluminum film sheet, jute and coir fiber for various number of layers are placed by applying resin. Jute 60% layers and coir 40% layers are positioned in the open mold, and resin is applied, brushed, or sprayed over. Air is removed with rollers to complete laminates structure. The thickness is controlled by layers placed against the mold, curing is done for 24 hrs so that work pieces will get hard. After that specimens are cut based on ASTM standards

V. RESULTS

1) *Tensile Strength:* The Tensile test is conducted on UTM machine at room conditions is a common method to evaluate strength and ductility under static load conditions. The tensile test is worked out by loading a standard specimen gripped at both ends and measuring the elongation of the specimens at various increments of loads.

Fig 1 : Sample A
60% coir and 40% kenaf

Fig 2 : Sample B
60% kenaf and 40% coir

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Fig 3 : Sample C
60% jute , 40% kenaf

Fig 4 : Sample D
60% jute and 40% coir

Table 1: Tensile Strength For Various Specimens

Sample Name	Density(kg/m3)	Tensile Strength(N/mm^2)
Sample A	522.3	658.21
Sample B	578.2	758.62
Sample C	642.3	869.88
Sample D	755.8	1016.26
Particle board	1173.5	1198.22

2) *Compression Strength:* Compression test is conducted at room condition to determine the compressive strength. The external faces of work piece are made perfectly plane. The specimen is held between the lower and the upper cross head of the C. T. M loading is applied gradually on to the specimen. The specimen undergo compression. At a particular load the needle starts to rotate anti clockwise, which is been noted as crushing load.

Fig 5: Sample A
60% coir and 40% kenaf

Fig 6: Sample B
60% kenaf and 40% coir

Fig 7 : Sample C
60% jute and 40% kenaf

Fig 8 : Sample D
60% jute and 40% coir

Table 2: Compression Strength For Various Specimens

Sample Name	Density(kg/m3)	Compression Strength (N/mm^2)
Sample A	522.3	70.77
Sample B	578.2	82.08
Sample C	642.3	73.95
Sample D	755.8	108.36
Particle board	1173.5	135.22

3) Water Absorption: The lower water consumption leads to a more uniform product to transmit loads with a greater capacity between the particles, resulting in higher internal bonding and flexural properties. In this test the specimen were placed in water for 24-48 hours. The NFCM which absorbs less water is considered to be the best.

Table 3: Water Adsorption For Various Specimens

Sample Name	Density (kg/m3)	Water Absorption Rate (%)
Sample A	522.3	55
Sample B	578.2	49
Sample C	642.3	46
Sample D	755.8	43
Particle board	1173.5	41

The physical & mechanical properties of NFCM & Particle Board. It is observed that out of all fabricated sample D has almost similar tensile strengths of particle board. Table 1 illustrates tensile strength respect to density which was found to be minimum for sample A(658.21.N/mm^2) and maximum for sample D (1016.26N/mm^2) which is slightly under the particle board (1198.22N/mm^2).The higher strength provides the board more strength which can consume different loads at different conditions. Table 2 describes the compression strength respect to density which was found to be minimum for sample A (70.77N/mm^2) and maximum for sample D (108.36N/mm^2) which is slightly under the particle board (135.22N/mm^2). The higher compression strength gives the higher stiffness at different environment. Table 3 shows the water absorption rate with respect to density which was found to be maximum for sample A (55%) and minimum for sample D (43%) which is slightly above of the particle board (41%). The lower water consumption leads to a more uniform product to transmit loads with a greater capacity between the particles, resulting in higher internal bonding in particleboards.

VI. CONCLUSION

The naturally occurring fiber (jute, coir and kenaf fiber) that are been reinforced with hardener HY 951 and Epoxy LY 556 as a resin are fabricated successfully using hand lay-up method. This work shows the capability of natural fiber reinforced composite materials. Mechanical properties of fiber composite based on different compositions of jute, Coir and kenaf has been characterized successfully. Analyzing the results, the better result is obtained from composite specimen contains 60% jute and 40% coir among the different types of samples. In comparison with the particle board found in market the sample containing 60% jute and 40% coir has comparable properties with approximately half of the cost of particle board.

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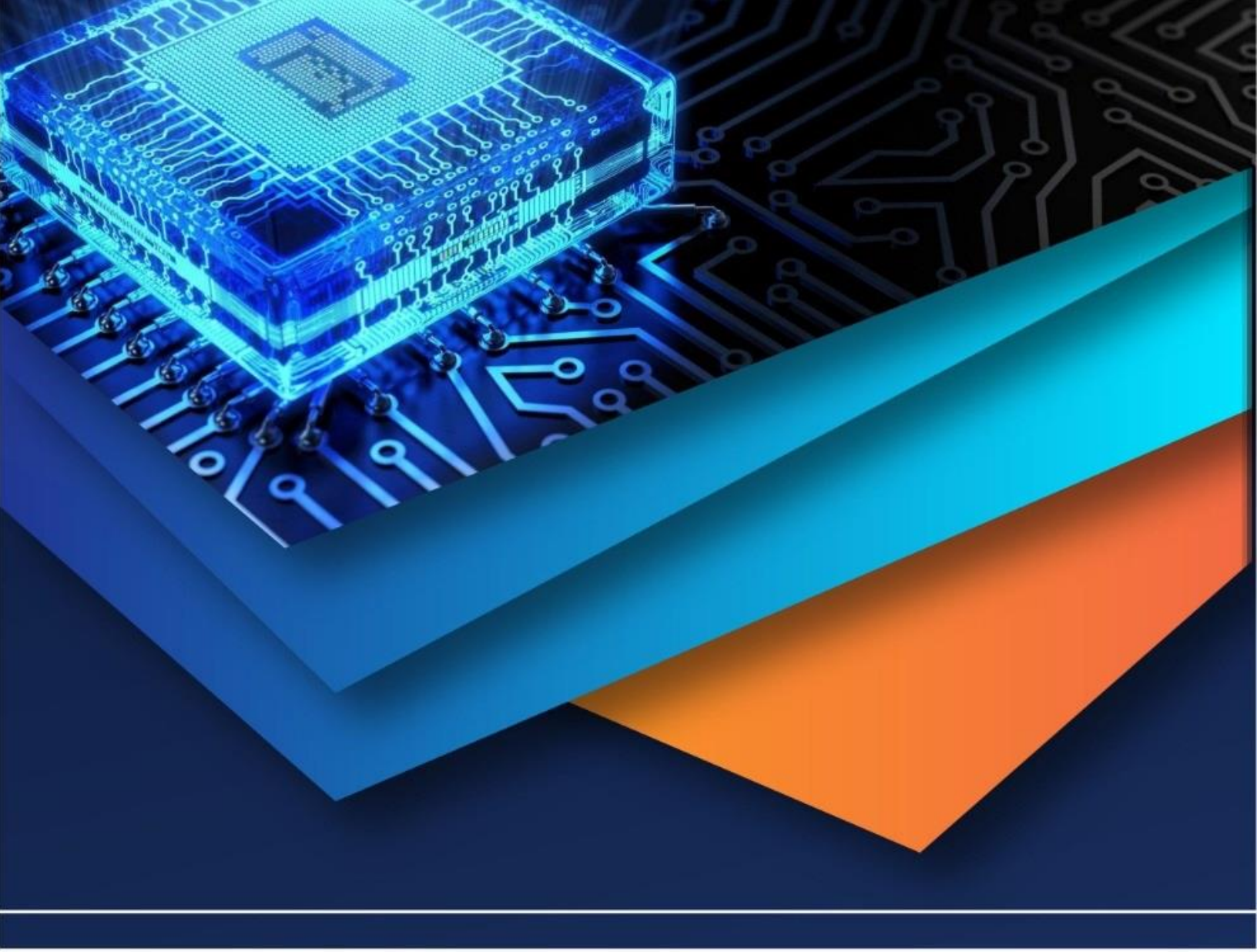

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